REMARKS

In response to a Final Office Action issued April 4, 2011, reconsideration of the application in light of the amendments and the following remarks is respectfully requested.

Status of the Claims

Claims 1-20 are pending. Claims 7-9 were withdrawn from consideration. Claims 1, 3, 6 and 10-13 were rejected. In this response, claims 1, 3, 10 and 11 have been amended. Claim 6 has been canceled. Claims 14-20 have been added. No new matter has been introduced.

Objections to Claim

Claim 3 was objected to because of an informality. In this response, claim 3 has been amended to correct the informality by replacing "a line obliquely" with -- the line obliquely --. No new matter has been introduced.

Rejections under 35 U.S.C. § 103

Claims 1-3, 6 and 10 were rejected under 35 USC § 103(a) as being unpatentable over Harris (US 3,445,148) in view of Tanaka (US Pub 2002/0001420). Claims 11-13 were rejected under 35 USC § 103(a) as being unpatentable over Harris in view of ***Shimizu*** (JP064-030922, Note that "***Teruo***" is a first name). Applicant respectfully disagrees.

Claims 1, 10 and 11 have been amended to further define the invention, while removing limitations which are incorporated into new claims 14-16. Support for this amendment can be found in paragraphs [0023]-[0025] and [0027] of the published application. Claim 17 has been added to further define the invention recited in claim 11. Support can be found in paragraph [0015] of the published application. Claims 18-20 have been added to further define the invention. Support can be found in paragraphs [0026] and [0027]. Claim 6 has been canceled without prejudice. No new matter has been introduced as a result of these amendments.

Journal part/enlarged diameter parts

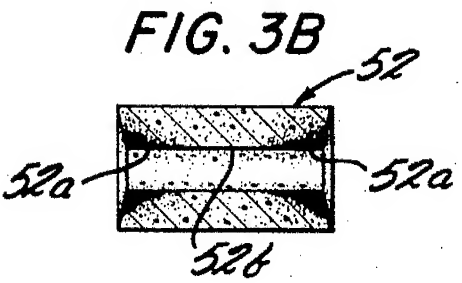
The present invention provides an oil-impregnated sintered bearing that supports a rotating shaft, comprising a journal part and enlarged diameter parts. Because the enlarged diameter parts are accurately formed to be less porous and thus more dense than the journal part, the following advantages are provided to the sintered bearing of the present invention:

Case A: When the axis of the rotating shaft is inclined in the bearing body due to a ***remarkably large*** torque applied to the shaft, the present invention provides the following advantages: 1) the surface of the rotating shaft is pushed against the enlarged diameter parts by a line, while properly supporting the rotating shaft, and 2) the journal part thermally expands due to pumping action and frictional heat caused by rotation of the rotating shaft, causing lubricating oil to come out of the inside of the bearing body in the journal part to lubricate the friction surface of the enlarged diameter parts.

Case B: When a strong runout occurs in the rotating shaft due to a ***large*** torque applied to the shaft, the present invention provides the following advantages: 1) the lubricating oil between the rotating shaft and the journal part is extruded into the space adjacent to the enlarged diameter parts, 2) the lubricating oil fills in between the rotating shaft and the enlarged diameter part, 3) since the enlarged diameter parts are more dense than the journal part, the lubricating oil is not impregnated into the enlarger diameter parts and remains between the rotating shaft and the enlarged diameter parts to apply reaction forces to the rotating shaft, and 4) deviation from the center of the rotating shaft is prevented.

Harris teaches a method of manufacturing a porous bearing whose surface has various densities. The portions of greater density are formed by pressing a "projection" that is projected from the surface of the bearing, ***then*** a finish ***sizing operation*** is performed followed by impregnation with oil (col. 4, lines 31-55). The Examiner states that "[t]he ***enlarged*** part in Harris is the chamfered surfaces at the end of the sleeve (Office Action, page 13)." Assuming that the Examiner is referring to the ***end*** of the bearing 52 in Fig. 3B, it is clear that this chamfer cannot

meet the claim language because it is inclined so steeply that it cannot be configured to support the rotating shaft. It is also apparent that a distance between the obliquely extending lines as recited in claims 1 and 10 is ***not*** substantially equal to the diameter of the rotating shaft. Attached is an enlarged view of Fig. 3B of Harris.



The Examiner cited Tanaka to compensate for this missing feature by referring to "tapering end surface 33" that is formed in an oil-impregnated sintered body. In the Office Action, the Examiner appears to believe that all of the structural features related to the ***enlarged diameter parts*** of the present invention are explicitly or implicitly disclosed by the combination of Harris and Tanaka. Applicant respectfully disagrees.

First, as shown in the above drawing, a portion of "relatively lower density and higher permeability and porosity," the portion also described as "zone 52b," contains an area that is pressed and thus greater in density. In other words, the "load-bearing portions 52a" partially extend to the zone 52b, which is equivalent to the journal portion of the present invention. Accordingly, there is

no clear border between the high density portions 52a and low density portion 52b. Although the claimed invention describes that "the sintered density of the enlarged diameter parts is ***larger than*** that of the journal part (claims 1, 10, and 11)," the density of the load-bearing portions 52a of Harris is ***not*** always larger than that of the zone 52b. Tanaka merely teaches "tapering end surfaces 33" and is silent about the accurate placement of the tapering end surfaces in the product. Thus, Tanaka does not provide any suggestion for one skilled in the art to modify the bearing of Harris to obtain the present invention.

Second, because the dense portion is ***accurately*** formed in the enlarged diameter parts, the present invention can enjoy the advantages discussed above, i.e., properly supporting the rotating shaft when it inclines. This accurate combination of the greater density and the enlarged diameter parts is made possible by the process where "the bearing hole that includes a journal part and has a constant diameter is formed ***first***, and then the enlarged diameter parts are formed on the basis of the bearing hole (paragraph [0027])." In this way, "positions of the enlarged diameter parts are accurately adjusted with respect to the journal part whereby angles between the inner surface of the journal part and the inclined planes of the enlarged diameter parts are also formed accurately (*ditto*)." In other words, merely placing a dense portion disclosed by Harris randomly on the bearing of Tanaka would not produce a sintered bearing of the present invention.

Further, in Harris, the portions with greater density are formed by pressing, or coining, a projection formed on the surface of a "compacted powder metal blank." The pressing (coining) process is performed ***before*** the sizing operation. In contrast, in the present invention, the sizing process (i.e., forming a journal part) is performed ***first***, followed by the pressing process (i.e., forming enlarged parts). Also, Harris requires the formation of a "projection" ***before*** a pressing (coining) process. The projection is a structure that is initially formed when the metal blank is made in a die using a conventional method (Harris, col. 3, lines 46-67). Thus, if Harris is combined with Tanaka, which discloses a tapering end surfaces 33, a ***projection must be formed first*** on the bearing surface, followed by a pressing process that creates a dense portion, then finally a sizing operation is performed so that tapering end surfaces are formed on the bearing. Under this process,

one skilled in the art would hardly expect the dense portion accurately formed on the tapering end surfaces because neither Harris nor Tanaka teaches the pressing process that is directly linked to the sizing operation.

Furthermore, in the present invention, a pair of cone-shaped press dies are used to form the enlarged diameter parts by simultaneously inserting them from both sides of the sintered body. On the contrary, only a single die is used in Harris. The method and tool used by Harris are therefore by no means similar to those of the present invention. Thus, one skilled in the art would not expect that the resulting structure would have the same or a similar bearing end .

Shimizu discloses a bearing hole that comprises a contour spread part 3b and a chamfered part 3c, but does not teach on how to form these structures. Also, the contour spread part 3b does not support the shaft 2 in Shimizu when the shaft is at an angle. Instead, lubricating oil between part 3b and the shaft prevent the shaft from deflecting.

Obliquely extending lines

Claims 1, 10 and 11 contain features that read, "a line obliquely extending along an inclined surface of one of the first parts is arranged ***parallel to*** a line obliquely extending along an inclined surface of the other first part, and a distance between the lines is substantially equal to the diameter of the rotating shaft." In the previous amendment filed March 16, 2011, Applicant argued that these features are not taught by Tanaka. In response, the Examiner dismissed this argument, stating that *"[I]n order to '**properly support**' the shaft, the tapered surfaces **must be** parallel and 'substantially equal' to the diameter of the rotating shaft*' (page 14)."

Applicant respectfully submits that the above statement made by the Examiner contains a logical error. In order to properly support the shaft, the tapered surfaces must ***not*** be parallel. It is assumed that the Examiner may have confused "necessary condition" with "sufficient condition." For example, a sentence that reads "*If it is an apple, it **must** be a fruit*" cannot be reversed to say "*If it is a fruit, it **must** be an apple.*" In this case, an apple is called "sufficient condition" to be a fruit, while a fruit is "necessary condition" to be an apple. The fruit cannot be "sufficient condition."

Similarly, what is recited in claims 1, 10 and 11 in the instant application is that because the bearing has a specific feature where "a line obliquely extending along an inclined surface of one of the first parts is arranged ***parallel to*** a line obliquely extending along an inclined surface of the other first part," the shaft ***must*** be ***properly*** supported. In short, if "parallel", then it must be "properly supported." However, "being properly supported" does not always mean "parallel, " (no reversed relation), because there are many other ways for the shaft to be "properly supported." For example, the third embodiment of the present application (i.e., Fig. 11) is designed to "properly support" the rotating shaft, but it does not have a feature that obliquely extending lines are arranged to be parallel. Fig. 10 of Tanaka may provide some hint, however it would not be sufficient for one skilled in the art to conclude that the tapering end surfaces of Tanaka carry the same or substantially similar structure.

In Harris, lines on the chamfers at the ends of the bearing in Fig. 3B would be parallel, but separated by far more than the diameter of the shaft which would be the diameter of the surface 52a. Lines along the surface 3b and 3c in Shimizu would not be parallel.

Rejections against claims 11-13

In rejecting claims 11-13 the Examiner also relies on Shimizu. However, these claims depend on claim 11 and Shimzu fails to provide the disclosure with respect to claim 11 that is missing from the combination of Harris and Tanaka as discussed above.

In light of the discussion above, no prior art reference or any combination thereof, teaches or suggest the above described sintered bearing, which makes claims 1, 10 and 11 unobvious. Claims 3 and 12-20 directly or indirectly depend from claims 1, 10 or 11, and thus they are also unobvious. Accordingly, Applicant respectfully requests that the rejections of claims under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the above amendments and remarks, Applicants believe the pending application and all pending claims are in condition for allowance, and earnestly solicit same.

If the Examiner feels that any remaining issues can be resolved by a Supplemental or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

The Commissioner is hereby authorized to charge any unpaid fees deemed required in connection with this submission, or to credit any overpayment, to Deposit Account No. 50-4570.

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Respectfully submitted,

By

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